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Investigation of conductivity and ambipolar transport of hydrogen in Ni doped $SrCe_{1-x}Y_xO_{3-\delta}$

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In recent years, developments in high temperature proton conductors have seen the introduction of transition metals into known proton conducting materials. These metals have been introduced both as dopants and additional phases in different studies.
Studies have shown that even small amounts of transition metal dopants are able to greatly change the overall conductivity. The nature of this change depends greatly on both the parent system and the choice of transition metal dopant, as well as microstructural effects. Both lower [1,2] and higher [3-5] conductivities have been reported, and similarly, both increased [e.g. 3] and unchanged or decreased sinterability [e.g. 1-2].
For use as electrolytes in fuel cells, pure ionic conductivity is vital and increased electronic conductivity would significantly reduce a materials potential in this field. For hydrogen separation membranes however, the situation is different, as protonic and electronic conductivities should both be high, preferably making up roughly half of the total conductivity each.
Therefore, we investigated the effect of introducing nickel as a B-site dopant into the well known proton conductor $SrCe_{1-x}Y_xO_{3-\delta}$. The total conductivity, in a series of samples with varying Ni-content, was measured using impedance spectroscopy as a function of both temperature and p_{O2}. Structural and microstructural features were investigated using powder x-ray diffractometry and scanning electron microscopy.
The applicability of the materials in hydrogen membranes was evaluated using electromotive force and hydrogen flux measurements. The measurements were compared to calculations based on defect chemical models of the materials.

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